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| 09/210,055 | 12/11/1998 | JOHN DAVID MILLER | 884.055US1 | 6122 |

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| EXAMINER | |
|---|---|
| WANG, JIN CHENG | |
| **ART UNIT** | **PAPER NUMBER** |
| 2628 | |

DATE MAILED: 07/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) |
|---|---|---|
| | 09/210,055 | MILLER, JOHN DAVID |
| | Examiner | Art Unit |
| | Jin-Cheng Wang | 2628 |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *18 May 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *20,22,24,26,28,32,34 and 37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *20, 22, 24, 26, 28, 32, 34 and 37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Response to Amendments*

Applicant's submission filed on 5/18/2006 has been considered. Claims 1-19, 21, 23, 25, 27, 29-31, 33, 35-36 have been canceled. Claims 22, 24, 26, 28, 32, 34, and 37 have been amended. Claims 20, 22, 24, 26, 28, 32, 34 and 37 are pending in the applications.

### *Response to Arguments*

Applicant's arguments filed May 18, 2006 have been fully considered but are not found persuasive in view of the ground(s) of rejection based on Shinohara U.S. Patent No. 5,880,735 (hereinafter Shinohara-735), in view of Shinohara U.S. Patent No. 5,877,769 (hereinafter Shinohara-769) and "Foley and Van Dam, "Fundamentals of Interactive Computer Graphics", Addison Wesley 1983, pp. 722-729, Demesa III et al. U.S. Patent No. 5,684,935 (hereinafter Demesa) and Wells et al. U.S. Patent No. 5,253,339 (hereinafter Wells).

Shinohara-735 teaches a method, comprising:

Identifying a first vector normal to a viewing surface (*Shihohara-735 discloses in column 8, lines 1-10 identifying the direction of the unit normal vector relative to the line-of-sight (viewing vector) and the planar surface of the polygon and identifying the direction of the line-of-sight which is a vector normal to a viewing surface such as human's face*), the first vector creating an angle of incidence at a second vector normal to the planar object surface (*the line-of-sight creates an angle of incidence at the planar surfaces of the polygon or exactly at the vertices/end points of the planar surfaces of the polygon; column 7, lines 63-67 and column 8, lines 1-10*); and

Modulating the transparency of an image of the object as a function of the angle of incidence (***column 10, lines 22-25 Shinohara-735 discloses the further the angle at which the direction of the line-of-sight intersects with the planar surface of the polygon, the lower the transparency becomes and thereby disclosing that the transparency of the pixels at the object surface is a function of the angle of incidence of the vector at the planar object surface).***

In other words, Shinohara-735 discloses in column 7-8 the direction of the line-of-sight meeting the claim limitation of "a first vector normal to a viewing surface" because the line-of-sight is normal to a human's eye/face wherein the human's eye/face is a viewing surface. Identifying the line-of-sight also identifies a line-of-sight normal to a viewing surface such as the human's eye/face as the line-of-sight is inherently normal to the human's eye/face and also identifies the viewing surface such as eye/face as related to the viewpoint of the human. The line-of-sight or viewpoint of a person is inherently normal to his eye/face. Shinohara discloses in column 7-8, an angle relative the direction of the line-of-sight and a planar surface of the polygon meeting the claim limitation of "an angle of incidence at the planar surface" (See Shinohara-735 column 7, lines 63-67 and column 8, lines 1-30).

Shinohara-735 discloses in column 7, lines 63-67 and column 8, lines 1-9 that the transparency is a function of the Z component Nz of the unit normal vector, which in turn is a function of the angle formed by the direction of the line-of-sight and a planar surface of the polygon. Therefore, the transparency is a function of the angle formed by the direction of the line-of-sight and a planar surface of the polygon. The output transparency thus changes as a function of the angle as claimed.

Shinohara-735 discloses in column 8, lines 19-30 that the angle formed by the polygon (planar surface) and the direction of the line-of-sight (a vector normal to a viewing surface) is a function of the Z component of the unit normal vector, which is a cosine function. For example, when the Z component of the unit normal vector is 1, the polygon (planar surface of the polygon) and the direction of the line-of-sight runs at a right angle to each other. When the Z component of the unit normal vector approaches zero, the angle formed by the polygon and the direction of the line-of-sight becomes reduced.

**At least based on the description at column 7, lines 63-67 and column 8, lines 1-30 of Shinohara-735, the normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz which is equal to the consine function of the angle of incidence (angle formed by the line-of-sight and the normal vector of the planar surface.**

Shinohara-735 does not expressly disclose the claim limitation that "wherein the function comprises a cosine function."

However, Shinohara-769 (in view of Foley) discloses the claim limitation that "wherein the function comprises a cosine function. Shinohara-769 discloses in column 7, lines 56-67 and column 8, lines 1-6 that the degree of blending is determined in accordance with the attribute data which indicates the reflectance given to each pixel when pixel data is generated by the filling circuit 9 wherein the filling circuit 9 sets the blending degree in the blend parameter register in accordance with the reflectance. If the reflectance is high, data read from the reflection map 14 is blended with the texture data with a high weight. If the reflectance is low,

blending is done with a low weight. Shinohara-769's blending of the polygon object requires a transparency associated with the reflectance value. It is well-known in the computer graphics art that the reflectance value is a function of the angle of incidence between the line-of-the sight and the planar surface, for example, a cosine function as taught in the Page 729 of the Foley **1983**'s computer graphics book wherein t**<u>he reflectance is a function of $\cos^n(\theta)$ to model specular reflection with the light at the viewpoint</u>** (n is the material's specular-reflection exponent). Shinohara-769 thus teaches that the transparency or the blending degrees being a function of the reflectance which is again a cosine function of the angle of incidence of the line-of-sight with the planar surface (Foley) Moreover, Shinohara-769 discloses the claim limitation of identifying a vector normal to a viewing surface and incident at an object having a planar object surface, the vector creating an angle of incidence at the planar object surface (Shinohara-769 **<u>Fig. 2</u>** and column 6, lines 20-25).

**ALSO based on the Fig. 2 of Shinohara-769, t<u>he normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz which is equal to the consine function of the angle of incidence (angle formed by the line-of-sight and the normal vector of the planar surface.</u>**

It would have been obvious to one of the ordinary skill in the art at the time of the invention was made to have incorporated Shinohara-769's teaching into Shinohara-735 because Shinohara-735 discloses in column 11, lines 15-25 that the output transparency depends upon the Z component of the unit normal vector at each vertex and in column 7, lines 63-67 and column 8,

lines 1-10 that the Z component of the unit normal vector at the vertex is 1 when the direction of the unit normal vector extends at an angle of 0 relative to the direction of the line-of-sight and a planar surface of the polygon and the direction of the line-of-sight run at a right angle to each other. The Z component of the unit normal vector at the vertex is 0 when the direction of the unit normal vector extends at an angle of 90 degree relative to the direction of the line-of-sight and the planar surface of the polygon and the direction of the line-of-sight run parallel to each other. Thus, Shinohara-735's output transparency is a function of the angle of incidence between the line-of-sight and the planar object surface, with the value changes in consistent with a cosine function of the angle of incidence. Shinohara-735 discloses in column 9, lines 15-25 that the **closer the angle formed by the planar surface of the polygon and the direction of the line-of-sight become to 90 degree, the larger the Z component of the unit normal vector becomes and therefore the larger the output transparency becomes** according to the formula set forth in column 7 and 11 wherein the output transparency is a function of the Z component. **Shinohara-735's transparency is a function of the Z component at the vertices of the planar surface wherein the Z-component at the vertices of the planar surface is a function of the angle of incidence. Therefore, Shinohara-735's transparency is a function of the angle of incidence.** Shinohara-735 thus teaches or suggests the claim limitation of "wherein the function comprises a cosine function."

In column 7, lines 63-67 and column 8, lines 1-30, Shinohara-735 teaches, the normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz which is equal to the consine function of the angle of incidence (angle formed by

the line-of-sight and the normal vector of the planar surface. **Shinohara-735 at least teaches or suggests the claim limitation wherein the function comprises a consine function.**

ALSO based on the Fig. 2 of Shinohara-769, the normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz which is equal to the consine function of the angle of incidence (angle formed by the line-of-sight and the normal vector of the planar surface. **Shinohara-769 at least teaches or suggests the claim limitation wherein the function comprises a consine function.**

One of the ordinary skill in the art would have been motivated to do this to modulate/illuminate/blend the object varying a function of the angle of incidence between the line-of-sight and the planar surface (**Shinohara-735 column 9, lines 15-25, Demesa column 8, lines 35-40 and Wells column 2, lines 25-40**).

The claim 1 recites a method claim. The claim states a series of steps for selecting, determining, calculating, assigning, comparing etc. The steps include determining a viewing angle, determining an object angle defined by a planar object surface, calculating a theta, equal the viewing angle minus the object angle plus pi, assigning a function of theta to alpha, if the mode is FRONT-ONLY or BOTH-SIDES, assigning a function of theta minus pi to alpha, if the mode is BACK ONLY; comparing alpha to zero; assigning zero to alpha, if the mode is FRONT ONLY and alpha is less than zero; assigning minus alpha to alpha, if the mode is BOTH-SIDES, and alpha is less than zero.

In response to applicant's arguments that the applicant's claimed methods embody applications that operate to modulate or generate the transparency of an image of an object, and as such, clearly comprise a practical application that achieves useful, concrete, and tangible final result. However, in contrary to applicant's arguments, the claim 1 only recites assigning a transparency factor to alpha, rather than assigning transparency factor to an image of an object. Therefore, rejection of claim 1 under 35 U.S.C. 101 should be maintained. Moreover, applicant merely recites calculating transparency of an image of an object as a function, which DOES Not produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601-02. The applicants have recited steps that do nothing more than manipulate basic mathematical representations, hence the claim is unpatentable. See *In re Warmerdam,* 33 F.3d 1354, 1360 (Fed. Cir 1994). Only an applicant's claims are entitled to the protection of the patent system; therefore claims, if expressing ideas in a mathematical form, must describe something beyond the manipulation of ideas in order to qualify as patentable subject matter. *In re Warmerdam,* at 1360. Given the absence of any practical effect or significant independent physical acts, the applicants' claim fails to adequately define the claimed invention within the domain of patentable subject matter.

The claimed invention as a whole must accomplish a practical application. That is, it must produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601-02. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of "real world" value, as opposed to subject matter that represents nothing more than an abstract idea or mathematical concept, or is simply a starting point for future investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36, 148 USPQ 689, 693-96); In

re Ziegler, 992, F.2d 1197, 1200-03, 26 USPQ2d 1600, 1603-06 (Fed. Cir. 1993)). Accordingly, a complete disclosure should contain some indication of the practical application for the claimed invention, i.e., why the applicant believes the claimed invention is useful. Given the absence of any practical effect or significant independent physical acts, the applicants' claim fails to adequately define the claimed invention within the domain of patentable subject matter.

In response to the applicant's arguments regarding the §103 rejection to the claims 22, 24, 26, 28, 32, 34 and 37, and 20; a *prima facia* case of obviousness has been established for the reasons given in above. Applicant stated that on Page 11, that "...this conclusion was affirmed as a result of the Pre-Appeal Request for Review submitted to the Office prior to the mailing of the instant Office Action. Thus Shinohara-735 has a fundamental deficiency: it does not 'create an angle of incidence at the planar surface of the polygon' as asserted in the Office Action". This argument is not justified because applicant had not attended the Pre-Appeal Conference and conjectured about the discussions in the Pre-Appeal Conference. However, what has been discussed in that Conference is whether the new ground rejection (set forth in the last Office Action) should be made. In contrary to applicant's conjecture and conclusion that the Pre-Appeal Conference has *confirmed* applicant's conclusion, the Pre-Appeal Conference has not confirmed applicant's conclusion.

Shinohara-735 discloses in column 7, lines 63-67 and column 8, lines 1-9 that the transparency is a function of the Z component Nz of the unit normal vector, which in turn is a function of the **angle formed by the direction of the line-of-sight and a planar surface of the polygon** meeting an angle of incidence at the planar surface of the polygon as claimed.

In column 7, lines 63-67 and column 8, lines 1-30, Shinohara-735 teaches, the normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz, which is equal to the consine function of the angle of incidence (angle formed by the line-of-sight and the normal vector of the planar surface. **Shinohara-735 at least teaches or suggests the claim limitation wherein the function comprises a consine function.**

ALSO based on the Fig. 2 of Shinohara-769, the normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz which is equal to the consine function of the angle of incidence (angle formed by the line-of-sight and the normal vector of the planar surface. **Shinohara-769 at least teaches or suggests the claim limitation wherein the function comprises a consine function.**

### *Claim Rejections - 35 USC § 101*

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The claim 1 recites a method claim. The claim states a series of steps for selecting, determining, calculating, assigning, comparing etc. The steps include determining a viewing angle, determining an object angle defined by a planar object surface, calculating a theta, equal the viewing angle minus the object angle plus pi, assigning a function of theta to alpha, if the mode is FRONT-ONLY or BOTH-SIDES, assigning a function of theta minus pi to alpha, if the

mode is BACK ONLY; comparing alpha to zero; assigning zero to alpha, if the mode is FRONT ONLY and alpha is less than zero; assigning minus alpha to alpha, if the mode is BOTH-SIDES, and alpha is less than zero.

The applicants have recited steps that do nothing more than manipulate basic mathematical representations, hence the claim is unpatentable. See *In re Warmerdam,* 33 F.3d 1354, 1360 (Fed. Cir 1994).

Patentable subject matter is held to exclude laws of nature, natural phenomena, and abstract ideas. *Diamond v. Diehr*, 450 U.S. 175, 185, 101 S.Ct 1048, 1056 (1981). Applicants' method claim is merely associated with selecting a mode (a number), determining a viewing angle...**assigning a function**... The claim 1 only recites assigning a transparency factor to <u>alpha</u>, rather than assigning transparency factor to an image of an object. Only an applicant's claims are entitled to the protection of the patent system; therefore claims, if expressing ideas in a mathematical form, must describe something beyond the manipulation of ideas in order to qualify as patentable subject matter. *In re Warmerdam,* at 1360. Given the absence of any practical effect or significant independent physical acts, the applicants' claim fails to adequately define the claimed invention within the domain of patentable subject matter.

The claimed invention as a whole must accomplish a practical application. That is, it must produce a "useful, concrete and tangible result." State Street, 149 F.3d at 1373, 47 USPQ2d at 1601-02. The purpose of this requirement is to limit patent protection to inventions that possess a certain level of "real world" value, as opposed to subject matter that represents nothing more than an abstract idea or mathematical concept, or is simply a starting point for future investigation or research (Brenner v. Manson, 383 U.S. 519, 528-36, 148 USPQ 689, 693-96); In

re Ziegler, 992, F.2d 1197, 1200-03, 26 USPQ2d 1600, 1603-06 (Fed. Cir. 1993)). Accordingly, a complete disclosure should contain some indication of the practical application for the claimed invention, i.e., why the applicant believes the claimed invention is useful. Given the absence of any practical effect or significant independent physical acts, the applicants' claim fails to adequately define the claimed invention within the domain of patentable subject matter.

Claim 22, 24, 26, 28 are rejected for the same reason set forth in above.

### *Claim Rejections - 35 USC § 112-Second Paragraph*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 37 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

<u>The scope of claim 37 is confusing</u> as it is unclear whether a computer readable medium or a method is being claimed. It is noted that the body of the claim is written as a method claim comprising modulating steps; however, **<u>the preamble of claim 37 is confusing</u>** including the computer-executable instructions as recited, e.g., a piece of paper having the computer executable instructions not <u>yet being executed in the computer</u>. Clarification is required.

Claims 32 and 34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 32 and 34 are confusing with regard to "a computer program capable of being executed" recited. First, a computer program not yet being executed in the computer such as the computer program written in a piece of paper is capable of being executed. Clarification is required.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 22, 24, 26, 28, 32, 34 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shinohara U.S. Patent No. 5,880,735 (hereinafter Shinohara-735), in view of Shinohara U.S. Patent No. 5,877,769 (hereinafter Shinohara-769) and "Foley and Van Dam, "Fundamentals of Interactive Computer Graphics", Addison Wesley 1983, pp. 722-729, Demesa III et al. U.S. Patent No. 5,684,935 (hereinafter Demesa) and Wells et al. U.S. Patent No. 5,253,339 (hereinafter Wells).

Re Claims 22, 24, 26, 28 32, 34 and 37:

Shinohara-735 teaches a method, comprising:

Identifying a first vector normal to a viewing surface (*Shihohara-735 discloses in column 8, lines 1-10 identifying the direction of the unit normal vector relative to the line-of-sight (viewing vector) and the planar surface of the polygon and identifying the direction of the line-of-sight which is a vector normal to a viewing surface such as human's face*), the first vector creating an angle of incidence at a second vector normal to the planar object surface (*the line-of-sight creates an angle of incidence at the planar surfaces of the polygon or exactly at the vertices/end points of the planar surfaces of the polygon; column 7, lines 63-67 and column 8, lines 1-10*); and

Modulating the transparency of an image of the object as a function of the angle of incidence (***column 10, lines 22-25 Shinohara-735 discloses the further the angle at which the direction of the line-of-sight intersects with the planar surface of the polygon, the lower the transparency becomes and thereby disclosing that the transparency of the pixels at the object surface is a function of the angle of incidence of the vector at the planar object surface).***

In other words, Shinohara-735 discloses in column 7-8 the direction of the line-of-sight meeting the claim limitation of "a first vector normal to a viewing surface" because the line-of-sight is normal to a human's eye/face wherein the human's eye/face is a viewing surface. Identifying the line-of-sight also identifies a line-of-sight normal to a viewing surface such as the human's eye/face as the line-of-sight is inherently normal to the human's eye/face and also identifies the viewing surface such as eye/face as related to the viewpoint of the human. The line-of-sight or viewpoint of a person is inherently normal to his eye/face. Shinohara discloses in

column 7-8, an angle relative the direction of the line-of-sight and a planar surface of the polygon meeting the claim limitation of "an angle of incidence at the planar surface" (See Shinohara-735 column 7, lines 63-67 and column 8, lines 1-30).

Shinohara-735 discloses in column 7, lines 63-67 and column 8, lines 1-9 that the transparency is a function of the Z component Nz of the unit normal vector, which in turn is a function of the angle formed by the direction of the line-of-sight and a planar surface of the polygon. Therefore, the transparency is a function of the angle formed by the direction of the line-of-sight and a planar surface of the polygon. The output transparency thus changes as a function of the angle as claimed.

Shinohara-735 discloses in column 8, lines 19-30 that the angle formed by the polygon (planar surface) and the direction of the line-of-sight (a vector normal to a viewing surface) is a function of the Z component of the unit normal vector. For example, when the Z component of the unit normal vector is 1, the polygon (planar surface of the polygon) and the direction of the line-of-sight runs at a right angle to each other. When the Z component of the unit normal vector approaches zero, the angle formed by the polygon and the direction of the line-of-sight becomes reduced.

**At least based on the description at column 7, lines 63-67 and column 8, lines 1-30 of Shinohara-735, the normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz which is equal to the consine function of the angle of incidence (angle formed by the line-of-sight and the normal vector of the planar surface.**

Shinohara-735 is silent to the claim limitation that "wherein the function comprises a cosine function."

However, Shinohara-769 (in view of Foley) discloses the claim limitation that "wherein the function comprises a cosine function. Shinohara-769 discloses in column 7, lines 56-67 and column 8, lines 1-6 that the degree of blending is determined in accordance with the attribute data which indicates the reflectance given to each pixel when pixel data is generated by the filling circuit 9 wherein the filling circuit 9 sets the blending degree in the blend parameter register in accordance with the reflectance. If the reflectance is high, data read from the reflection map 14 is blended with the texture data with a high weight. If the reflectance is low, blending is done with a low weight. Shinohara-769's blending of the polygon object requires a transparency associated with the reflectance value. It is well-known in the computer graphics art that the reflectance value is a function of the angle of incidence between the line-of-the sight and the planar surface, for example, a cosine function as taught in the Page 729 of the Foley **1983** computer graphics textbook wherein t**he reflectance is a function of $\cos^n(\theta)$ to model specular reflection with the light at the viewpoint** (n is the material's specular-reflection exponent). Shinohara-769 thus teaches that the transparency or the blending degrees being a function of the reflectance which is again a cosine function of the angle of incidence of the line-of-sight with the planar surface (Foley) Moreover, Shinohara-769 discloses the claim limitation of identifying a vector normal to a viewing surface and incident at an object having a planar object surface, the vector creating an angle of incidence at the planar object surface (Shinohara-769 **Fig. 2** and column 6, lines 20-25).

**ALSO based on the Fig. 2 of Shinohara-769, the normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz which is equal to the consine function of the angle of incidence (angle formed by the line-of-sight and the normal vector of the planar surface.**

It would have been obvious to one of the ordinary skill in the art at the time of the invention was made to have incorporated Shinohara-769's teaching into Shinohara-735 because Shinohara-735 discloses in column 11, lines 15-25 that the output transparency depends upon the Z component of the unit normal vector at each vertex and in column 7, lines 63-67 and column 8, lines 1-10 that the Z component of the unit normal vector at the vertex is 1 when the direction of the unit normal vector extends at an angle of 0 relative to the direction of the line-of-sight and a planar surface of the polygon and the direction of the line-of-sight run at a right angle to each other. The Z component of the unit normal vector at the vertex is 0 when the direction of the unit normal vector extends at an angle of 90 degree relative to the direction of the line-of-sight and the planar surface of the polygon and the direction of the line-of-sight run parallel to each other. Thus, Shinohara-735's output transparency is a function of the angle of incidence between the line-of-sight and the planar object surface, with the value changes in consistent with a cosine function of the angle of incidence. Shinohara-735 discloses in column 9, lines 15-25 that the **closer the angle formed by the planar surface of the polygon and the direction of the line-of-sight become to 90 degree, the larger the Z component of the unit normal vector becomes and therefore the larger the output transparency becomes** according to the formula set forth in column 7 and 11 wherein the output transparency is a function of the Z component.

**Shinohara-735's transparency is a function of the Z component at the vertices of the planar surface wherein the Z-component at the vertices of the planar surface is a function of the angle of incidence. Therefore, Shinohara-735's transparency is a function of the angle of incidence.** Shinohara-735 thus teaches or suggests the claim limitation of "wherein the function comprises a cosine function."

In column 7, lines 63-67 and column 8, lines 1-30, Shinohara-735 teaches, the normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz, which is equal to the consine function of the angle of incidence (angle formed by the line-of-sight and the normal vector of the planar surface. **Shinohara-735 at least teaches or suggests the claim limitation wherein the function comprises a consine function.**

ALSO based on the Fig. 2 of Shinohara-769, the normal vector at vertex along the planar surface of a general polygon exactly equates to the normal vector at each pixel of a planar surface of the polygon. Therefore, the transparency is a direct function of Nz which is equal to the consine function of the angle of incidence (angle formed by the line-of-sight and the normal vector of the planar surface. **Shinohara-769 at least teaches or suggests the claim limitation wherein the function comprises a consine function.**

One of the ordinary skill in the art would have been motivated to do this to modulate/illuminate/blend the object varying a function of the angle of incidence between the line-of-sight and the planar surface (**Shinohara-735 column 9, lines 15-25, Demesa column 8, lines 35-40 and Wells column 2, lines 25-40**).

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Obata U.S. Patent No. 5,222,203 (hereinafter Obata) in view of Shinohara U.S. Patent No. 5,880,735 (hereinafter Shinohara-735) and Shinohara U.S. Patent No. 5,877,769 (hereinafter Shinohara-769) and "Foley and Van Dam, "Fundamentals of Interactive Computer Graphics", Addison Wesley 1983, pp. 722-729, Demesa III et al. U.S. Patent No. 5,684,935 (hereinafter Demesa) and Wells et al. U.S. Patent No. 5,253,339 (hereinafter Wells).

Claim 20:

Obata teaches selecting a mode, the mode is FRONT-ONLY, BOTH SIDES, or BACK-ONLY (*The mode is* ***in relation to*** *the viewpoint vector, the light source vector and the normal vector of the object surface. The directions of these vectors govern the mode for FRONT-ONLY, BOTH SIDES, or BACK-ONLY; column 7*),

determining a viewing angle (<u>Determining VE to be the same as VL</u>; *Obata discloses viewpoint vector in Fig. 2 wherein the eye position changes with respect to the object surface which in turn changes the mode with respect to the object. It would have been obvious to move the viewpoint position exactly at the light source position so that the viewpoint vector coincides with the light source vector and therefore theta depends on the normal vector at the object surface and the viewpoint vector as the viewpoint vector coincides with the light source vector. Moreover, Obata has extra freedom of selecting/determining both the viewpoint vector and the light source vector. The opposite light source vector –VL with respect to the reference x-axis of an arbitrary reference frame forms the viewing angle and the light source vector VL coincides*

*with the viewpoint vector VE. For the sake of subsequent explanation, the angle is denoted by va_alpha*),

determining an object angle defined by a planar object surface (*e.g., object having surfaces have been described through the cited reference and therefore the object as taught by the reference refers to the three-dimensional object rather than a two-dimensional object. The lines illustrated in Figs. 2, 8 and 10 as related to the translucent object wherein the light source and viewpoint vectors intersect with represent the planar surfaces of the object in which the transparency of the object surface is the subject matter. <u>Determining VN</u>; The normal vector of the planar object surface with respect to the reference x-axis of an arbitrary reference frame forms the object angle. For the sake of subsequent explanation, the angle is denoted by oa_beta. Moreover, Fig. 6 shows an object with planar surfaces and thus the object as taught by the cited reference is three-dimensional rather than two-dimensional. Thus, the description as related to Fig. 2 applied to three-dimensional object having planar surfaces illustrated in Fig. 6 and the viewpoint vector and light source vector intersect with the planar surfaces of the translucent object; See also Figs. 8 and 10*),

calculating a theta, equal the viewing angle minus the object angle plus pi (*theta is the angle between the normal vector VN and the viewpoint vector VE which is in relation to the previously identified viewing angle and object angle. By definition of theta, theta is equal to pi – oa_beta + va_alpha; column 7*),

assigning a function of theta to alpha, if the mode is FRONT-ONLY or BOTH-SIDES (*the alpha being the cosine function of theta; see column 6*),

*Obata explicitly discloses in Figs. 2 and 8 the angle of incidence theta and the brightness value or the color value depends on a non-linear function of the angle theta (column 6-7). From Obata's disclosure, the theta angle depends on the light source vector VL and the normal vector VN. By definition, the angle theta is equal to pi – {the angle between the normal vector VN of the object surface with respect to the x-axis of any reference frame} + {the angle of the opposite light source vector –VL (viewing from the light source) with respect to the x-axis of any reference frame}. The angle between the normal vector VN of the object surface with respect to the x-axis of any reference frame is the object angle of the claimed invention and the angle of the opposite light source vector –VL as viewing from the light source with respect to the x-axis of any reference frame forms the viewing angle of the claimed invention. The viewing angle and the object angle are inferred from the Obata's disclosure in Figs. 2 and 8 and column 6-7. The viewing angle and the object angle are directly related to the angle theta and the angle theta is critical for the determination of the color value or the transparency value and Obata.*

*Because the color value or transparency value can never be less than zero, alpha = cos (theta) should be always larger than or equal to zero, Obata implicitly teaches comparing alpha to zero; assigning zero to alpha, if the mode is FRONT_ONLY (<u>FRONT_ONLY mode is a mode formed by the position or location of the viewing source or the light source in relation to the object surface and therefore is decided by the relationship of the viewing source vector or the light source vector VL and the normal vector VN at the object surface</u>) and alpha is less than zero. Similarly, Obata implicitly teaches the transparency value to be larger than zero or equal to zero and thereby Obata teaches assigning zero to alpha, if the mode is BACK_ONLY, and alpha less than zero. Because the color value or transparency value can never be less than zero,*

*alpha = cos (theta) should be always larger than or equal to zero, Obata implicitly teaches assigning minus alpha to alpha, if the mode is BOTH-SIDES, and alpha is less than zero (column 6-7). These above steps are measures to prevent the alpha value being less than zero which one of the ordinary skill in the art should understand that alpha value for alpha blending should not be less than zero.*

Therefore, Obata further discloses assigning a function of theta minus pi to alpha, if the mode is BACK ONLY (*Note that the mode changes when the light source and the viewpoint changes with respect to the object surface. Assigning a function of theta minus pi is equivalent to assigning a function of theta because cosine of theta minus pi reflects the brightness value after blending with the light source or the background image and is equal in absolute value to cosine of theta. BACK_ONLY corresponds to the viewpoint vector VE and the light vector being in opposite direction in which VN is rotated 180 degrees to obtain a normal vector and FRONT_ONLY corresponds to the viewpoint vector VE being in the same direction to the light source vector VL; column 6-7*);

comparing alpha to zero; assigning zero to alpha, if the mode is FRONT ONLY and alpha is less than zero (*Since the brightness value for an image object should be positive, the inner product between the normal vector of the object surface and the light source vector or cosine(pi – oa_beta +va_alpha) should be positive as well; column 6-7*); assigning zero to alpha, if the mode is BACK ONLY, and alpha less than zero (*the image object is displayed as an opaque object and since the brightness value for an image object should be positive, alpha value should be zero if it is less than zero*);

assigning minus alpha to alpha, if the mode is BOTH-SIDES, and alpha is less than zero (*since the brightness value for an image object should be positive, alpha value should be zero if it is less than zero*; column 6-7).

In other words, Obata discloses a method for displaying a translucent object or an opaque object on a display screen comprising a step of displaying a translucent object by calculating the color intensity. The color intensity comprises an ambient light component and the diffused transmitted light component, which is in relation to an angle made between a normal vector of the object surface and a light source vector as being at normal to the light surface, the diffused transmitted light coefficient, and the intensity value corresponding to the light source. The angle of incidence of the incident light source being over the range of 0 to pi, so that the object develops its own color intensity on the basis of the diffused transmitted light coefficient Ktr, the intensity value corresponding to the incident light from a light source. The intensity or brightness of the image object is described by the color and/or transparency values. Obata teaches that, <u>the actual display color of the image object is determined by **mixing the color of the image object and the color of the background image**</u>, <u>based upon the transmissivity of the translucent object</u> (column 1). T*he transmissivity of the object is reflected as coefficient value in the image blending which is not related to the alpha value at all.* Obata teaches that, by appropriately setting the coefficients associated with the intensity components, the display of an opaque object or a translucent object can be controlled in such a way that an opaque object can be displayed by providing a zero value output from <u>the diffused transmitted light</u> component and a translucent object can be displayed by providing zero value outputs from the diffused reflection light component and the specular reflection light component (column 7) wherein the background

object is displayed as blurred to obtain a superior realistic display (column 6). In the case for translucent image object, the intensity of the image object is governed by the Itr component which is proportional to the transparency factor. The transparency of the image object is determined by a number of the input parameters such as the diffused transmitted light coefficient and reflection coefficient of ambient light depending upon the relationship among the light source, the viewpoint and the object surface. The transparency is zero for an image object to be displayed as an opaque object after setting the coefficients associated with the intensity components or parameters under certain conditions. The intensity of the diffused transmitted light greatly varies in accordance with the angle theta made between the normal vector of the object surface and the light source vector as being normal to the light source surface and how much the light comes through depends upon the cosine function of theta. The angle theta is usually 0 to pi, and theta = pi signifies the case that the object surface is at a position opposite to the light source, whereas theta = 0 means the case that the object surface is in a parallel and opposed relation to the light source so that it is in the most bright condition.

Moreover, Obata a mode is in relation to the viewpoint vector, the light source vector and the normal vector of the object surface. The directions of these vectors govern the mode for FRONT-ONLY, BOTH SIDES, or BACK-ONLY. The three vectors offer extra freedom in selecting a mode.

Although Obata does not explicitly disclose that the viewpoint vector to be exactly the same as the light source vector, it would have been obvious to locate the viewpoint to the same position as the light source as the viewpoint position can be moved to the light source position. Obata at least suggests the viewpoint vector to be exactly the same as the light source vector by

stating that the viewpoint and the light source are determined to be on the same side of the translucent surface and Fig. 2 also discloses that the viewpoint vector and the light source vector are in the opposite side of the object surface and therefore Obata teaches that the viewpoint position is movable with respect to the object surface.

*It would have been obvious to move the viewpoint position exactly at the light source position so that the viewpoint vector coincides with the light source vector and therefore theta depends on the normal vector at the object surface and the viewpoint vector as the viewpoint vector coincides with the light source vector. Moreover, Obata has extra freedom of selecting/determining both the viewpoint vector and the light source vector.*

One of the ordinary skill in the art would have been motivated to move viewpoint position at the light source position to view the translucent surface of the object (Obata column 7, lines 33-65) and *the eye position changes with respect to the object surface which in turn changes the mode with respect to the object (Fig. 2).*

However, Obata does not specifically teach the claim limitation of "assigning a transparency factor to alpha".

Shinohara-735 discloses the claim limitation of assigning a transparency factor to alpha (*e.g., Shinohara teaches determining a transparency at each pixel based upon a Z component of the unit vectors and the factor is related to the angle at which the direction in which the surface of the polygon is inclined and therefore it becomes possible to change the transparency depending upon the angle relative to the direction of the line-of-sight and the planar surface; column 4, lines 1-50; and column 7, lines 36-62. Shinohara further discloses that the Z-component of the unit vector depends on the angle formed by the planar surface of the polygon,*

*the direction of the line-of-sight. See column 1, lines 60-67 and column 2, lines 1-2; see column 9. P=1, Nz=cos(theta); and a_out = a_in * Nz; see column 7, lines 35-67 and column 8, lines 1-9 in which Nz changes from 0 to 1 and therefore the output transparency is changed from opaque a_out = 0 to clear a_out = a_in; see also column 1*).

It would have been obvious to have incorporated Shinohara-735's assigning a transparency factor to alpha to Obata's method because Obata suggests the claim limitation of "assigning a transparency factor to alpha". In column 1 and 6-7, Obata teaches that, the actual display color of the image object is determined by **mixing the color of the image object and the color of the background image**, based upon the transmissivity of the translucent object which **dictates** the coefficients associated with the formula for calculating the brightness values (column 1).

Shinohara-769 (in view of Foley) discloses the mixing of the color of the image object and the color of the background image is governed by a blending degree as a function of the reflectance value. Shinohara-935 discloses in column 7, lines 56-67 and column 8, lines 1-6 that the degree of blending is determined in accordance with the attribute data which indicates the reflectance given to each pixel when pixel data is generated by the filling circuit 9 wherein the filling circuit 9 sets the blending degree in the blend parameter register in accordance with the reflectance. If the reflectance is high, data read from the reflection map 14 is blended with the texture data with a high weight. If the reflectance is low, blending is done with a low weight. Shinohara-769's blending of the polygon object requires a transparency associated with the reflectance value. It is well-known in the computer graphics art that the reflectance value is a function of the angle of incidence between the line-of-the sight and the planar surface, for

example, a cosine function as taught in the Page 729 of the Foley 1983 book wherein t**the reflectance is a function of $\cos^n(\theta)$ to model specular reflection with the light at the viewpoint** (n is the material's specular-reflection exponent). Shinohara-769 thus teaches that the transparency or the blending degrees being a function of the reflectance which is again a cosine function of the angle of incidence of the line-of-sight with the planar surface (Foley) Moreover, Shinohara-769 discloses the claim limitation of identifying a vector normal to a viewing surface and incident at an object having a planar object surface, the vector creating an angle of incidence at the planar object surface (Shinohara-739 Fig. 2 and column 6, lines 20-25).

With the teaching of Shinohara-739 and Foley, it is understood the interrelationship of the blending factor and the specular reflectance factor as a function of the angle formed by the direction of the line-of-sight and the planar object surface. In column 1 and 6-7, Obata teaches that, the actual display color of the image object is determined by **mixing the color of the image object and the color of the background image wherein the mixing depends upon the specular reflectance factor as a function of the angle formed by the direction of the line-of-sight and the planar object surface.**

Moreover, it should be known that Obata teaches that, by appropriately setting the coefficients associated with the intensity components, the display of an opaque object or a translucent object can be controlled in such a way that an opaque object can be displayed by providing a zero value output from the diffused transmitted light component and a translucent object can be displayed by providing zero value outputs from the diffused reflection light component and the specular reflection light component (column 7) wherein the background object is displayed as blurred to obtain a superior realistic display (column 6). In the case for

translucent image object, the intensity of the image object is governed by the Itr component which depends upon the material transparency factor. The brightness value of the image object is determined by a number of the input parameters such as the diffused transmitted light coefficient and reflection coefficient of ambient light and the final brightness result of the image object depends upon the material transparency value. The transparency is zero for an image object to be displayed as an opaque object after setting the coefficients associated with the intensity components or parameters, depending on the relationship among the light source, viewpoint and the object surface. The intensity of the diffused transmitted light greatly varies in accordance with the angle theta made between the normal vector of the object surface and the light source vector (viewpoint vector) as being normal to the light source surface (or viewpoint surface). The angle theta is usually 0 to pi, and theta = pi signifies the case that the object surface is at a position opposite to the light source, whereas theta = 0 means the case that the object surface is in a parallel and opposed relation to the light source so that it is in the most bright condition.

Finally, Obata teaches that, *by appropriately setting the coefficients associated with the intensity components*, the display of an opaque object or a translucent object (two different opacity values associated with the same image object) is realized. In the case for translucent image object, the intensity of the image object is governed by the Itr component and therefore **Itr is proportional to the transparency factor** for the blending of the effect of light source and the translucent image object. In this case, the brightness value is only determined by Itr because he transparency of the image object with respect to the light source is determined by a number of the input parameters such as the diffused transmitted light coefficient and reflection coefficient of ambient light wherein only Itr component determines the color of the translucent image object

(column 7, lines 12-25) so that *the outline of a light source* which is ***seen through*** (blended with opacity values) **the translucent object is blurred to obtain a superior realistic display of the translucent object**. The other term in the image blending as being proportional to (1-alpha) is set to zero due to the fact that the coefficients related to other components are set to zero. Note that the transparency is zero for an image object to be displayed as an opaque object after setting the coefficients associated with the intensity components or parameters.

In a non-limiting example, the transparency or opacity value of an image object pixel is proportional to cos (theta) which is the inner product between the normal vector of the object surface and the viewpoint vector being perpendicular to the viewing surface (say eye ball). If the viewpoint vector is in perpendicular to the object surface, cos (theta) = 1, resulting in the maximum opacity. It is also noted that the viewpoint vector and the light source vector of the prior art reference may be changed instead of fixed relative to each other and therefore this example applies only to a very specific situation in which the sheet face or the object surface being perpendicular to the viewpoint while the viewpoint vector and the light source vector are in opposite direction. If both the viewpoint and the light source are perpendicular to the sheet of paper, the transparency or opacity of the sheet of paper is maximum because cos(theta) = 1.

It would have been obvious to have incorporate Shinohara's assigning the transparency factor to alpha into Obata's method for *setting the coefficients associated with the intensity components* so that the display of an opaque object or a translucent object (two different opacity values associated with the same image object) is realized.

Therefore, according to the teaching of Obata, it would have been obvious to assign a transparency factor to alpha similar to what has been done in Shinohara. Doing so would enable

the modification of the color of the object by **mixing the color of two image objects such as the image object and the color of background image**. One of the ordinary skill in the art would have been motivated to do this to modulate/illuminate/blend the object varying a function of the angle of incidence between the line-of-sight and the planar surface (**Shinohara-735 column 9, lines 15-25, Demesa column 8, lines 35-40 and Wells column 2, lines 25-40**).

## *Conclusion*

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jin-Cheng Wang whose telephone number is (571) 272-7665. The examiner can normally be reached on 8:00 - 6:30 (Mon-Thu).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kee Tung can be reached on (571) 272-7794. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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